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GROB G-112: FLIGHT TESTING FULFILLS EXPECTATIONS

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16. Abstract

The article describes the G-112 aircraft built by Burkhart Grob in time to be exhibited at the ILA '84. It has a new G-2500 engine designed especially for this purpose, economical and requiring little maintenance and generating a power of 66 kW (90 Hp), with which the aircraft achieves cruising speed of 185 km/h, using a drastically reduced amount of fuel, only 17 liters aviation fuel or premium gasoline. If the G-112 arouses sufficient interest of the national and international market, it will be built in mass production, and further improvements are planned.

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GROB G-112: FLIGHT TESTING FULFILLS EXPECTATIONS

"The G-112 flight fulfills our expectations, and the behavior /673* under spin appears to be so free of problems that we do not expect any further difficulty";this was the report received by the editors of Aeorkurier a few days before leaving for the ILA (International Air Show). Thus, Burkhart Grob has been able to build the G-112, which had been eagerly awaited, in time to bring it to Hanover along with the first results of flight testing.

Apart from the long distance multi-purpose model G-111 (see also Aeorkurier 5/84), the G-112 was the second novelty with which Grob surprised the technical experts at the airshow. The Mindelheim Company emphasized thus its claim that it would apply in the future the know-how acquired in building modern high-performance type gliders in the industrial construction of aircraft with fiberglass reinforced plastic or fine-grained plastic in building power planes also, so as to not only achieve relatively high flight performances, but also primarily much more economical aircraft.

Unlike other manufacturers, Burkhart Grob is not satisfied with the engines available on the market. For him it does not make sense to develope an optimal aerodynamic system at great cost and then use an engine for which the fuel consumption is far inferior than that which is technically feasible today.

For want of suitable choices on the market, Grob decided to develope his own engine, the G-2500. This relatively economical and presumably also low-maintenance engine generates capacity of 66kW (90 hp) and thus gives the G-112 a cruising velocity of about 100 knots or 185 km/h. The Grob engine will require only 17 liters of aviation fuel or premium gasoline per hour and therefore drastically reduces the fuel consumption for aircarft of this category.

The G-112 is, after the G-110 project (see also in this context /674

*Numbers in the Margin indicate pagination in the foreign text.

Aeorkurier 3/82, page 258), the second attempt of the company from Mindelheim to develope a modern power plane. This fact alone shows how seriously Grob takes the development of power planes and, therefore, also the approach to the production of light single engine aircraft, an area which lay fallow much too long in the Federal Republic of Germany since the shut-down of production of the Monsun aircraft by Bolkow.

People have been wondering both in this country and abroad why such an otherwise successful German building of gliders has shown as much as not interest in building power planes.

Know-how in the field of aerodynamics and production technology has been accumulating in the sector of German glider building more than almost anywhere else, both elementary pre-requisites to overcome the lack observed at this time of innovations in the production of single engine sport and passenger planes.

But this time too it was up to the Grob aircraft manufacturing company to play the role of leader. The foundation was laid in recent years with the G-109 and the new G-109B. The G-110, which made its first flight in the beginning of 1982, was then the first attempt at developing an up-to-date power plane.

We may, however, recall how unsatisfactory the spin properites were, which led last year to the interruption in the development of the G-110. For the company from Mindelheim which was so used to success otherwise, this set-back was a bitter disappointment, more so as such difficulties had not been expected. Burkhart Grob suffered the consequences. The G-110 development was stopped, the G-111 program was moved up and thus the company obtained the necessary breather to throroughly revise once again the power plane project.

In this context it must be said that the spin behavior of an aircraft can only be predicted with difficulty today even theoretically while between theory, model test and practice considerable differences may arise, an experience with which several other manufacturers

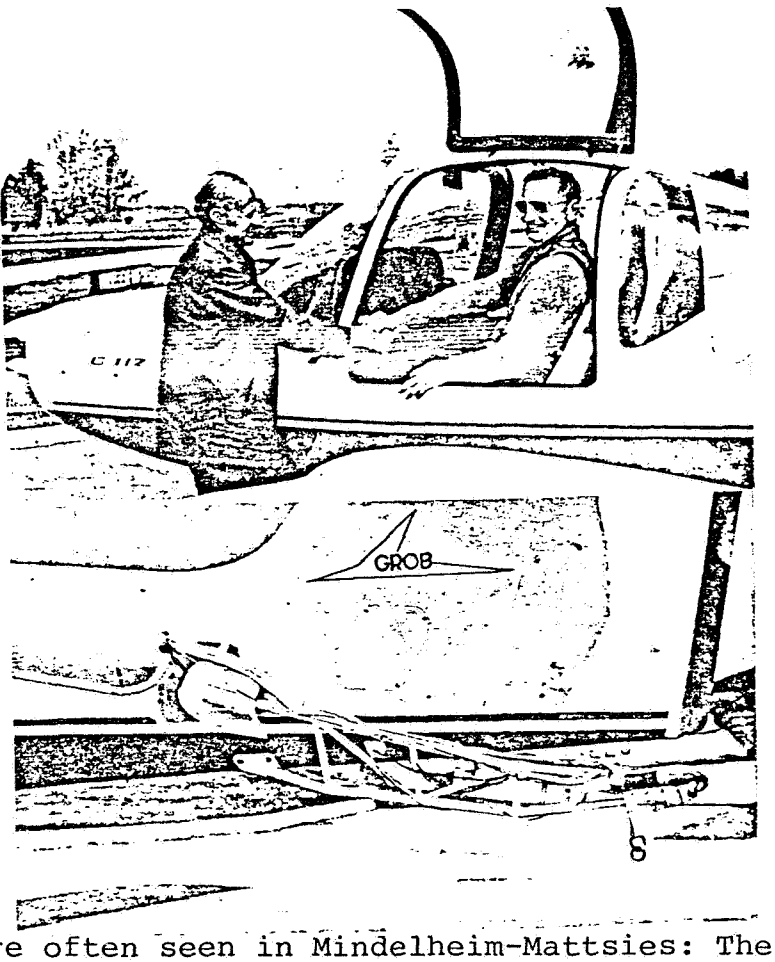
have had to cope before.

After the G-112 had proven its performances in its first flight (the first flight took place on May 4) in the middle of May Grob concentrated everything on the key question, how would the new aircraft behave in a spin? It is understandable that Burkhart Grob did not wish to bring the G-112 to the ILA without having tested the aircarft under spin. This was the lesson learned in the experience with the G-110.

At the beginning of May it was impossible to carry out any spin tests because of very poor weather and low cloud cover. On May 15 finally the time had come: good visiability and sunshine offered the right conditions for the first spin test. The test pilot was Sandor Farkas (48) who had a reputation in technical circles not only as an outstanding acrobatic pilot but also as a spin specialist.

Sandor Farkas, who had just returned from the Antarctic as pilot of the Dornier 228 Polar 2 aircraft, had already flown the G-112 on its first flight on May 4th.

The G-112 had hardly landed after the spin test, and the first results had been evaluated when Burkhart Grob told Aerokurier: "Today we started the spin test with a central position of the center of gravity. After a spin deflection, the correction both to the left and to the right proved to be absolutely free from problems. It took place after only a quarter to half rotation. With the result we are very confident and expect no more surprises in further flight testing."



A picture often seen in Mindelheim-Mattsies: The head of the Burkhart Grob Company expresses his congratulations on the successful first flight of a new machine. This time the test pilot is Sandor Farkas (48), known as an outstanding acrobatic pilot and spin specialist. Farkas who had recently flown as pilot of the Dornier 228 in the German Antarctic expedition, reported after the first hours of testing about the harmless and pleasant flight properties of the G-112. For the spin test carried out on May 15, on the left of the fuselage a spin parachute had been mounted. In case of emergency, it is released with a small rocket to stablize the aircraft (bottom).

Cost Killer?

The struggle against costs is becoming increasingly a matter of life and death in our motor plane sports; the manufacturers of flight equipment are faced with particular challenges in this connection. The pilot expects from them technical solutions which are suitable not only for clearly reducing fuel consumption, but also the other costs of aircraft maintenance. Many manufacturers seem to have recognized meanwhile the needs of the moment. With the same goal, that is, the reduction of costs, it seems that two areas of

development have unfolded under the technical aspect. Whereas some of them for example consider that one solution is a drastic simplification of the flight equipment, of which the Robin ATL represents the best example (see also Aerokurier 5/84, page 554), others consider an improvement in technique to reduce the cost through technology. The key to the improvement of the economy lies here in the conversion of an optimum aerodynamic system into a simple concept under the production aspect, exluding the engine. It is only possible to achieve this with the modern fiberglass reinforced plastic construction, because only this construction will allow the unlimited adaptation of the frame to the aerodynamic requirements, guaranteeing the correctness of the shape which is so immensely important for modern profiles and is able to contribute greatly to reducing the resistance through high surface quality. We may add to this the other advantages of the composite fiber structure, such as the insensitivity to bad weather, the considerable protection against fatigue phenomena, corrosion, and last but not least the facility of repair.

Garage Instead of Hangar

However, there is not patent method for reducing costs in power flight; it is primarily not enough simply to reduce the consumption or fly more quickly with a given power unit power, to produce cheaper passenger-kilometers.

Aircraft cost a lot of money today even if they do not fly at all, or, to put it better, even if they remain on the ground; the question here is parking and storage fees, especially in hangar areas. The latter have become in short supply in many German landing strips, less because there are too many aircraft, but rather because in many airports hardly any new hangars could or have been built for a long time. Even today the yearly costs for keeping planes in a hangar are considerable.

While the glider pilots, for example, can help in this respect by dismantling the aircraft after flight operations and keeping the machine in hangars, today in most cases the pilot of a power plane has to bear the cost load for parking places without any limitations.

If hangar rent goes according to the area required, then the storage costs should be drastically reduced for the G-112 because of its folding wings, because only a relatively very small area is needed for this aircraft with its "ears laid back". Moreover, the aircraft may be "boxed up" even more efficiently with folded surfaces than would be otherwise possible through the bulky geometry.

Inspite of the folding wings, the G-112 retains the necessary flexibility in operation. The wings can be unfolded by the pilot even without many helpers with a few hand movements, while there is nothing much that can be done wrong, since all the rudders and flap connections are engaged automatically.

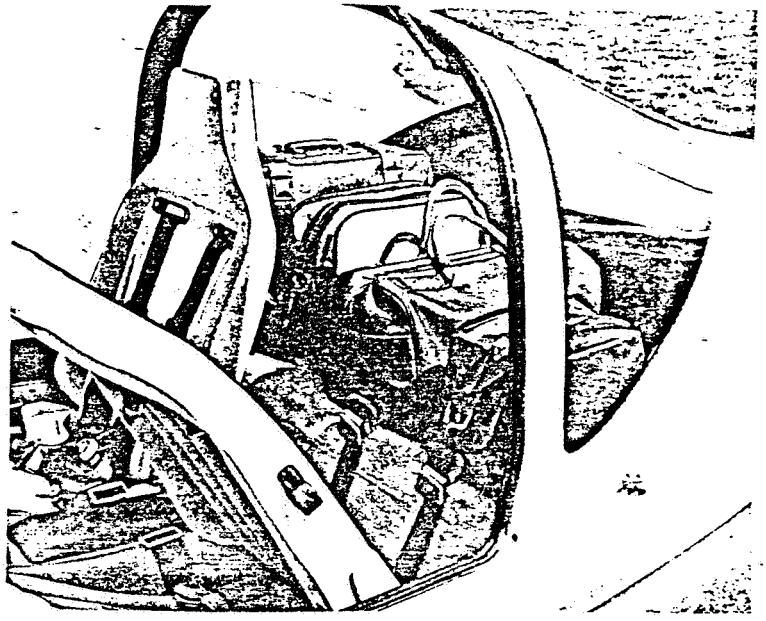
Thus the G-112 becomes the first mass-produced power plane of general aeronautics, which offers these great advantages. An important pre-requisite here is that the tank of aircraft be installed in the fuselage, so that when folding no problems should arise with /675
fuel lines, tank ventilation, etcetera. Furthermore, the method for folding the wings has been well-known for a long time in power gliders, so that hardly any problems should arise for the G-112 from this technical innovations.

Roomy Cabins

The classical means of reducing the resistance is the reduction of the cross-section area to the mimumum needed. This results in aircraft whose resistance patterns were improved by such measures having very narrow cabins and therefore offering only little space for the arrangement of the cockpit and cabin in accordance with the present requirements for flight comfort.

But for a generally high aerodynamic quality aircraft, when reducing the cabin cross-section it may be possible to proceed on a somewhat more liberal basis, without having to put up with exceptionally high drawbacks in the performance. This possibility was used by Grob for the G-112 and offers space which was previously unknown in this type of aircraft. With a width of 1.20m. Grob offers thus almost a level of comfort comparable now-a-days to a medium-sized car. In the

choice of the seat therefore, it was not necessary to search for space saving solutions. Here too Grob aimed at the standard of comfort of the automobile industry, and therefore it is not surprising that the two adjustable seats even have integrated head supports. The seats are unfortunately only longitudinally adjustable. It should be considered whether it would not also be reasonable to choose for this line a seat which would also be adjustable in height.



The easily accessible luggage compartment is located in the the G-112 behind the convenient seats. Up to 30kg can be stored there. Altogether the payload of the new Grob two-seater aircraft is 220kg.

Preliminary Working Data

Naturally the large cabin width also facilitates the organizationof the instrument panel. In the arrangement of instruments, operating elements and the COM/NAV system therefore is no need for a tightly packed emergency solution, but it is possible to have a panel orgnizations which is adjustable even to very exacting ergonomic requirements.

GROB G-112 DATA TABLE /675

Manufacturer		Grob Aircraft Construction Mindelheim-Mattsies
Model		G-112
Crew		1 + 1
Power Unit		Grob 2500 F1
Power	kW Hp at RPM	66 90 3000
Propeller		MTV-1-A/L 160-03
Span	m	11.00
Length	m	6.89
Height	m	2.15
Wing Area	m^2	12.32
Aspect Ratio		9.8
Tare Weight	kg	530
Useful Load	kg	220
Maximum Take-Off Weight	kg	750
Maximum Suface Load	kg/m^2	60.9
Power Loading	kg/kW kg/Hp	11.7 8.6
Maximum Velocity in Horizontal Flight	km/h Knots	220 113
Cruising Speed	k/h	185
(75% in 1000m)	Knots	100
Stalling Speed	km/h Knots	85 46
Speed of Climb	m/s fpm	3.0 590
Maximum Range	km Nm	1550 837
Take-Off and Taxi Run	m	250
Take-Off Run Over 15 m	m	510

For a company which has developed through the construction of gliders, there can be no compromise regarding the conditions of visibility from the aircraft. Precisely in the generally dense flight traffic at landing areas and glider landing places even in fine weathr a perfect all-round vision is absolutely necessary for an unimpeded observation of the air space. In developing the G-112 great efforts have also been made in this regard, so that the field of visibility should be limited only by the natural anatomical limitations of the pilot.

The vision directly upwards is only limited by a small roof strip which however is absolutely necessary with regard to winged doors opening upwards to assure convenient access. This door design as found also for example in the TB aircraft family of Aerospatiale appears to be applied increasingly in power flight; on one hand these doors allow convenient access to the cabin, on the other they offer a certain amount of protection in case of rain. But the doors themselves are also protected, especially as regards the scratching of the window glass when entering or leaving the aircraft or in the loading and unloading of the luggage.

Drive

The constant complaints regarding the long technical standstill in the construction of aircraft engines are loud and clear. Here we must lay considerable blame for this omission on the American engine manufacturers, who have more or less totally dominated the market during the last decades. Specifically, it is possible to produce engines of high reliability, but the fuel consumption of these engines in no way corresponds to modern possbilities. For Burkhart Grob, connected closely with automobile building through its other industrial activities, it was absolutely necessary to equip a modern aircraft with a technically revised engine, quite apart from the fact that for a two-seater plane like the G-112, no suitable engines were available as regard performance. This applies also to the Porsche Flight Engine which is intended for much larger aircraft.

On the basis of the experience acquired in building power gliders,

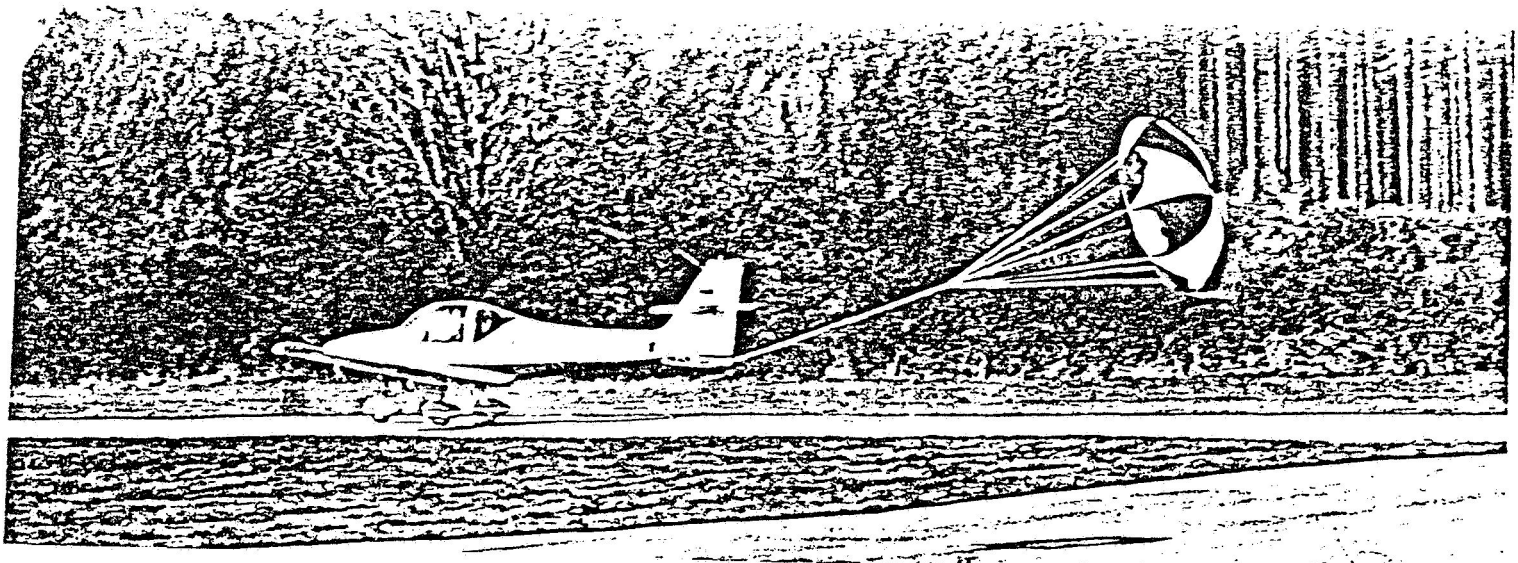
at Gorb, they started developing their own four cylinder power unit designated as G-2500. This engine generates at the speed of revolution of 3000 rpm a power of 66 W, or 90 Hp.

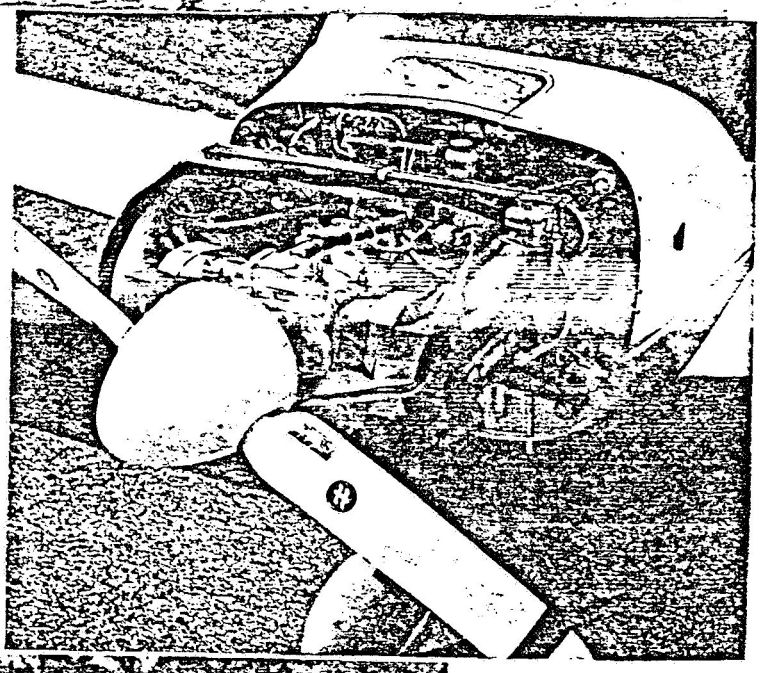
It is encouraging that this engine can be operated both with aviation fuel and with premium gasoline (motor fuel). For cruising flight at around 135 km/h, Grob is expecting a consumption of 17 liters per hour. With suitable throttled power the hourly consumption can be reduced to 8 liters, during which the G-112 reaches still a velocity of 130 km/h according to the existing results of the flight testing. Flying with a tank volume of 100 liters in fast cruising flight, a flight time of 5.5 hours can be obtained without reserves, or a range of about 1000km. In the fuel saving cruising flight the tank supply is sifficient for a calculated flight of 12.5 hours, or a maximum range of 1550 km. Thus a wide range of applications is offered to this two-seater in air sport as well as for passenger flight. Starting from the Federal Republic of Germany, almost all central European destinations can be reached non-stop with a G-112. The maximum range of about 1550km makes the G-112 ideal for air travel, even at relatively low cruising speed, and would tempt people to fly over a long distance with this small two-seater. The standard equipment including a constant speed propeller which for any speed range will insure that the engine performance is used in an optimum manner, is new for an aircraft of thie type; the propeller pitch is designated as "Grob system" according to the company, and is distinguished by a particularly simple operating system.

Performances

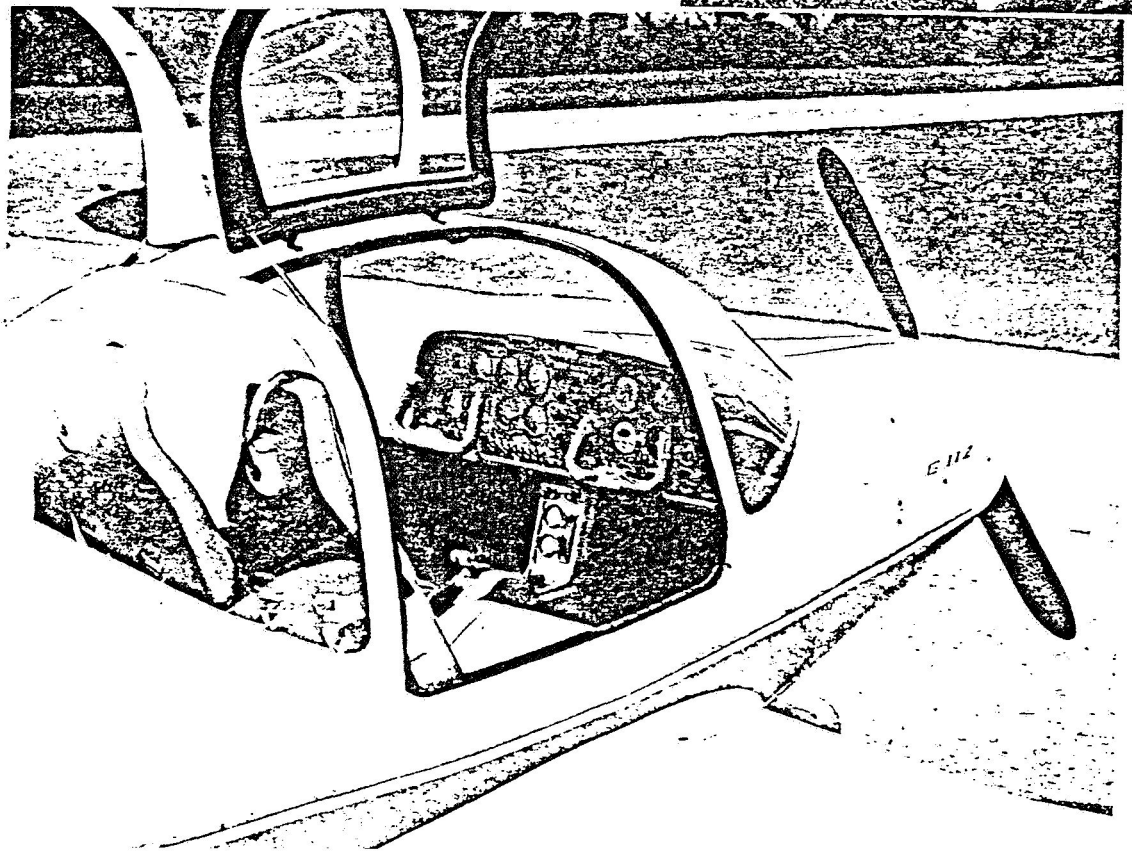
In spite of its small engine unit the G-112 reaches a maximum flight velocity of 220 km/h. The small two-seater requires only a very short take-off and taxi run of about 250 meters. The initial speed of climb was estimated at 3.0m/s, a value which was confirmed meanwhile in flight testing. Because of the low surface load of only about 61 kg/m^2, the good slow flight properties of the profile may be utilized totally. According to the available results of flight testing the stalling speed is about 85 km/h. The broad speed range of the G-112 makes it possible with this aircarft to join the traffic

flow to a small landing area without raising any difficulties, as well as to approach a commercial airport without becoming a flying traffic obstacle. But in the design of the landing gear, Grob started from realistic conditions of use, that is the radar and landing gear design were chosen in such a way that they could be used also to the permanent operation from poorer grassy areas. Naturally, foot brakes have not been omitted, which allow easy maneuvering in a narrow space.





Top: Rolling test with spin parachute, which was attached at the tail and is released with a small rocket.
Right: The four cylinder G-2500 engine, which can also be operated with motor fuel, generates 66 kW (90Hp).
Bottom: The unique two-seater cockpit is based upon the comfort level of the middle class automobile. Adjustable seats with head rests increase this exacting standard.



Chances for the Two-Seater

Although the development in recent years, at least as reagrds the comparison of the numbers of permits, tends clearly towards a four-seater space. Grob believes that there are good chances for the renaissance of the two-seater market. The pre-requisite for this is mainly that the seat costs per hour of flight should not be higher than for a four-seater, and that the purchse costs based on the number of seats should tend towards a similar order of magnitude. Quite apart from a traditional role of a two-seater in instruction, training and in sport, Grob expects also an increasing interest in the aircraft in the category of passenger travel and by charter companies. In this connection Grob is parimarily concerned with the cost advantages which such an aircraft has compared with the four-seater. In many cases four-seater power planes have been selected only because they were more attractive simply from the space offered by the cabin, although, for example, only two places were used. In the G-112, thanks to the cabin built on generous dimensions, the two man crew with luggage can travel without being very cramped for sapce. In this connection, however, it would be desirable if the permissible luggage load in the G-112 could be increased from the present 30 to 40kg, naturally with full tank load and two people on board. Here an improvement is still absolutely necessary.

Burkhart Grob leaves no doubts to the effect that the G-112 is intended to be the initial model for a whole aircraft family. Already in its present state of development the G-112 allows the incorporation of more powerful engines and therefore higher flight performances. But before preceeding futher, they are waiting for the reactions of the market. As regard the market for the G-112, Grob is hoping primarily for considerable interest from clubs and flight school. Precisely in this area, where the considerable increase in cost of recent years has had a particularly negative effect, they have been waiting for a long time for aircraft which is suitable for reducing the operating cost and therefore the hourly cost of flight. In this difficult mark, where nothing is really given away, the G-112 must prove itself. If it is successful, an international success for this aircraft and also for the planned improvement may be feasible.